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Science Advisory Report 2007/039

REVISED PROTOCOL FOR CONDUCTING RECOVERY POTENTIAL ASSESSMENTS

Figure 1: Department of Fisheries and Oceans' (DFO) six administrative regions.

Context:

When the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses an aquatic species and recommends a status of Threatened or Endangered, DFO undertakes a number of actions required under the Species at Risk Act (SARA). Science information is required as early as possible in this "post-COSEWIC" process, to support development of scenarios for evaluating the social and economic costs of recovery, to inform public consultations, and serve other jurisdictional functions regarding the decision to list a species on Schedule 1 of SARA. Scientific information is needed on the current status of the species, threats to its survival or recovery, and actions or alternatives possible to address the threats, particularly with regard to Section 73.3 of the Act. When a species is listed as Threatened, Endangered or Extirpated under SARA, the information is also needed by the Recovery Team to develop a Recovery Strategy and , if applicable, one or more Action Plan(s) for the species.

In 2004, DFO Science developed a set of guidelines for conducting evaluations of the likelihood of recovery of threatened, endangered or extirpated species under various assumptions about how human activities that affect the species would be managed (CSAS 2004). These Guidelines for "Recovery Potential Assessments (RPAs)" were developed at a time when jurisdictions had little experience with assessing recovery potential of species under the provisions of SARA. After three years of operations under the 2004 Protocol for RPAs, a workshop was held in August 2007 to review how well the guidelines have functioned in practice, and how well the products produced under the 2004 Protocol have met the needs of other Sectors of DFO. This workshop included participants from DFO Science in every Region, all DFO Sectors, two provinces, and Parks Canada, which has also been developing guidelines and practices for jurisdictional actions following COSEWIC listing recommendations. The meeting resulted in a number of improvements to the Protocol, and clarification of several aspects of the implementation of the revised 2007 Protocol.

December 2007

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SUMMARY

Recovery Potential Assessments should routinely address the following tasks. In every case, the best science advice possible should be provided with the information that can be assembled and uncertainties taken into account.

Phase I: Assess current/recent species status

1. Evaluate **present species status** for abundance, range and number of populations.
2. Evaluate **recent species trajectory** for abundance, range, and number of populations.
3. Estimate, to the extent that information allows, the current or recent **life history parameters** for the species (total mortality [Z], natural mortality[m], fecundity, maturity, recruitment, etc.) or reasonable surrogates, and associated uncertainties for all parameters.
4. Address the separate terms of reference for describing and quantifying (to the extent possible) the **habitat requirements and habitat use patterns** of the species.
5. Estimate expected **population and distribution targets** for recovery, according to DFO guidelines.
6. Project **expected population trajectories** over three generations (or other biologically reasonable time), and trajectories over **time to the recovery target** (if possible to achieve), given current population dynamics parameters and associated uncertainties using DFO guidelines on long-term projections.
7. Evaluate **residence requirements** for the species, if any.

Phase II: Scope for management to facilitate recovery.

8. Assess the **probability that the recovery targets can be achieved** under current rates of population dynamics parameters, and **how that probability would vary with different mortality** (especially lower) **and productivity** (especially higher) **parameters.**
9. Quantify to the extent possible the **magnitude of each major potential source of mortality** identified in the pre-COSEWIC RAP and considering information in COSEWIC Status Report, from DFO sectors, and other sources.
10. Quantify to the extent possible the **likelihood that the current quantity and quality of habitat is sufficient** to allow population increase, and would be sufficient to support a population that has reached its recovery targets (using the same methods as in step 4)
11. Assess to the extent possible the magnitude by which current **threats to habitats have reduced habitat quantity and quality.**

Phase III: Scenarios for mitigation and alternative to activities

12. Using input from all DFO sectors and other sources as appropriate, develop an **inventory of all feasible measures to minimize/mitigate** the impacts of activities that are threats to the species and its habitat (steps 9 and 11).

13. Using input from all DFO sectors and other sources as appropriate, develop an inventory of all reasonable **alternatives to the activities** that are threats to the species and its habitat (steps 9 and 11), but with potential for less impact. (e.g. changing gear in fisheries causing bycatch mortality, relocation of activities harming habitat)
14. Using input from all DFO sectors and other sources as appropriate, develop an inventory of all **reasonable and feasible activities that could increase the productivity or survivorship parameters** (steps 3 and 8).
15. Estimate, to the extent possible, the **reduction in mortality rate expected** by each of the mitigation measures in step 12 or alternatives in step 13 and **the increase in productivity or survivorship** associated with each measure in step14.
16. Project **expected population trajectory** (and uncertainties) over three generations (or other biologically reasonable time), and to the time of reaching recovery targets when recovery is feasible; given mortality rates and productivities from 15 that are **associated with specific scenarios** identified for exploration. Include scenarios which provide as high a probability of survivorship and recovery as possible for biologically realistic parameter values.
17. Recommend **parameter values for population productivity and starting mortality rates,** and where necessary, specialized features of population models that would be required to allow exploration of additional scenarios as part of the assessment of economic, social, and cultural impacts of listing the species.

INTRODUCTION

Recovery of species at risk of extinction usually requires reductions to the mortality rate suffered by the species and/or improvements to its productivity (used here to refer to the expected reproductive output of a species). Each type of change often requires the responsible jurisdictions to take actions to address threats to the species or its habitat and/or to augment the species productivity or quality and quantity of its habitat. The necessary actions can have both direct costs to implement the actions, and social and economic consequences following from restrictions placed on if, where, and how activities can be conducted that may affect the species or its habitat.

The provisions of SARA, particularly 73.3, are quite prescriptive with regard to the responsibilities of a jurisdiction relative to supporting the recovery of species listed as Threatened, Endangered or Extirpated on Schedule 1. Activities that might kill, harm, or harass a listed species or destroy its habitat or residence are generally prohibited unless a permit for the activity is issued by the Minister of the responsible jurisdiction. The Minister can only issue such permits if satisfied that the permitted activity will not jeopardize survival or recovery of the species, that all reasonable alternatives to the activity that would reduce the impact on the species have been considered and the best solution has been adopted, and that all feasible mitigation measures are in place.

Science advice is necessary on all of these considerations, such that complete Science support would include addressing at least the following questions:

- What is the current status and trajectory of the species (or population)?

- What are biologically reasonable recovery targets and timeframes to reach recovery for the species?
- What features characterize the habitat of the species?
- Where is the habitat found at present, how much habitat is known to exist currently, and how much habitat was known to exist historically?
- What are the current threats to the species and its habitats?
- What is the likelihood of reaching the biological recovery targets with current productivity and mortality rates estimated for the species?
- What mortality rates and/productivities would be associated with alternative ways of conducting activities that affect the species?
- By how much would various mitigation measures be expected to alter the mortality rate and/or productivity of the species?
- Effectiveness of current management measures, if any are in place.

ANALYSIS

The context for provision of the advice

These are all fundamentally scientific questions, whose answers are needed to inform policy and management decisions. However, most of them can only be addressed successfully in cooperation with other Sectors and usually with various external experts and/or stakeholders. Meetings to address these advisory issues need to be planned with engagement of the other Sectors of DFO, and participation needs to give significant attention to inclusion from all Sectors of DFO, other levels of government and often other federal departments and agencies, industry sectors, and public interest groups.

Timing of the advice from the RPA is important. DFO is committed to consult widely with Canadians prior to the Minister providing recommendations to the Governor in Council regarding listing of a species under the provisions of SARA. These consultations commonly include both discussions of the measures needed for the species to recover and the possible new or increased restrictions that might be placed on social, cultural, and economic activities in the species' range, in order to ensure recovery. The scientific advice on the questions above is necessary for those consultations to have a sound science basis.

DFO undertakes modelling and analysis to explore and quantify the potential consequences of alternative scenarios for activities that meet the provisions of Section 73.3 of SARA but might kill, harm, or harass a species or destroy its habitat. This information can then be used to determine the social and economic costs of listing in cases where listing an aquatic species under SARA might require particularly restrictive measures for recovery, or otherwise might have important social or economic consequences. This modelling is also important for Recovery Planning and permitting.

To best serve the ends of other DFO Sectors, RPAs are of greatest value when they occur by the end of the summer following the spring COSEWIC meeting where a species is assessed and a status of Threatened, Endangered, or Extirpated is recommended. There are a number

of SARA provisions that specify timelines for processes related to listing and preparation of Recovery Strategies and Action plans, and some provide options to jurisdictions that may extend the necessary timelines for the provision of advice. However, the starting point for planning is the summer following the COSEWIC assessment, and deferrals of timing are made only when client Sectors needing the advice are satisfied that advice at a later time will not reduce its usefulness.

DFO cannot wait for the spring COSEWIC meeting before commencing preparations for an RPA because of the workload involved in preparing for a full RPA. A working arrangement with the COSEWIC Specialist Groups considering aquatic species is necessary in order for effective science support to be provided to other DFO sectors through RPAs. Effective RPAs will also benefit from the earlier provision of information to COSEWIC Status report authors. Although the primary focus of this Science Advisory Report is improvements to the 2004 Protocol for RPAs, some recommendations and conclusions are included regarding science information needed at the pre-COSEWIC peer review and advisory stage.

Contents of a Recovery Potential Assessment

RPAs should routinely address the following tasks. It is expected that the importance of individual steps may vary on a case-by-case basis, and only partial information will often be available to address each step. Nonetheless, in every case **the best science advice possible with the information that can be assembled should be provided**. Because of the time sensitivity of the advice relative to actions required by other DFO Sectors, steps should be deferred to later meetings only when there is a compelling need for the delay, and client sectors are comfortable with the expected timing of the deferred parts of the advice.

Phase I: Assess current/recent species status

To the extent possible with the information available and taking account of uncertainties:

1. Evaluate **present species status** for abundance, range and number of populations.
2. Evaluate **recent species trajectory** for abundance, range, and number of populations.
3. Estimate, to the extent that information allows, the current or recent **life history parameters** for the species (total mortality [Z], natural mortality[m], fecundity, maturity, recruitment, etc.) or reasonable surrogates, and associated uncertainties for all parameters.
4. Address the separate terms of reference for describing and quantifying (to the extent possible) the **habitat requirements and habitat use patterns** of the species.
5. Estimate expected **population and distribution targets** for recovery, according to DFO guidelines.
6. Project **expected population trajectories** over three generations (or other biologically reasonable time), and trajectories over **time to the recovery target** (if possible to achieve), given current population dynamics parameters and associated uncertainties using DFO guidelines on long-term projections.
7. Evaluate **residence requirements** for the species, if any.

Phase II: Scope for management to facilitate recovery.

To the extent possible with the information available and taking account of uncertainties:

8. Assess the **probability that the recovery targets can be achieved** under current rates of population dynamics parameters, and **how that probability would vary with different mortality** (especially lower) **and productivity** (especially higher) **parameters.**
9. Quantify to the extent possible the **magnitude of each major potential source of mortality** identified in the pre-COSEWIC RAP and considering information in COSEWIC Status Report, from DFO sectors, and other sources.
10. Quantify to the extent possible the **likelihood that the current quantity and quality of habitat is sufficient** to allow population increase, and would be sufficient to support a population that has reached its recovery targets (using the same methods as in step 4)
11. Assess to the extent possible the magnitude by which current **threats to habitats have reduced habitat quantity and quality.**

Phase III: Scenarios for mitigation and alternative to activities

To the extent possible with the information available and taking account of uncertainties:

12. Using input from all DFO sectors and other sources as appropriate, develop an **inventory of all feasible measures to minimize/mitigate** the impacts of activities that are threats to the species and its habitat (steps 9 and 11).
13. Using input from all DFO sectors and other sources as appropriate, develop an inventory of all reasonable **alternatives to the activities** that are threats to the species and its habitat (steps 9 and 11), but with potential for less impact. (e.g. changing gear in fisheries causing bycatch mortality, relocation of activities harming habitat)
14. Using input from all DFO sectors and other sources as appropriate, develop an inventory of all **reasonable and feasible activities that could increase the productivity or survivorship parameters** (steps 3 and 8).
15. Estimate, to the extent possible, the **reduction in mortality rate expected** by each of the mitigation measures in step 12 or alternatives in step 13 and **the increase in productivity or survivorship** associated with each measure in step14.
16. Project **expected population trajectory** (and uncertainties) over three generations (or other biologically reasonable time), and to the time of reaching recovery targets when recovery is feasible; given mortality rates and productivities from 15 that are **associated with specific scenarios** identified for exploration. Include scenarios which provide as high a probability of survivorship and recovery as possible for biologically realistic parameter values.
17. Recommend **parameter values for population productivity and starting mortality rates,** and where necessary, specialized features of population models that would be required to allow exploration of additional scenarios as part of the assessment of economic, social, and cultural impacts of listing the species.

Commentary on the Steps

Steps 1 and 2: If the pre-COSEWIC Science peer review and advisory process was thorough and complete, these steps should only require an update of the key population status time-series provided to COSEWIC, and re-running the analyses that had been determined at the pre-COSEWIC peer review to be the best possible with the quantity and type of information available. In some cases, COSEWIC will have selected different Designatable Units (DUs) than used in the pre-COSEWIC peer review and advisory meeting. In such cases it will be necessary in the RPA to update the status and trend information of the DUs, but if considered appropriate, the RPA can evaluate status and trends for other population units as well. Here, and in all steps, traditional and community knowledge should be used as fully as appropriate to ensure a comprehensive and inclusive information base for the advice.

Step 3: The life history parameters that are most crucial for the RPA to assess depend on the life history of the species being assessed. However, the threats to a particular species may also justify giving particular attention to some specific life history parameters as potentially crucial for evaluating recovery potential. At this time, no specific guidelines are available on what life history parameters are most important in specific circumstances. Sound ecological reasoning and forward planning with clients of the advice should guide selection of the parameters to be assessed on a case-by-case basis. In cases where information is limited for the direct estimation of a key life history parameter, surrogates that can be estimated should be sought, or information borrowed from other populations or species considered ecologically similar enough to provide relevant information. In all cases the uncertainty of the parameter estimates and their covariances should be estimated and used appropriately in the subsequent analyses – both later steps in this Protocol and modelling undertaken after the RPA meeting concludes.

Step 4: A thorough pre-COSEWIC peer review process should describe the nature of habitats required and used by the species, and the major known threats to those habitats as fully as information allows. Guidelines for quantifying the quality and quantity of habitat available at present, and needed for a species to achieve recovery goals for abundance, range and number of populations have been developed separately. They are available as CSAS SAR 2007/xx, and its updates, if any.

Step 5: The selection of specific recovery targets for a species is done as part of the Recovery Strategy. However, information about the life history of the species and its historical status provides a starting point for estimating population sizes and ranges that are realistic to expect to achieve under a successfully implemented and SARA-compliant Recovery Strategy. It can also provide likely timescales for achieving those population sizes and ranges. Realized timeframes and recovery levels depend on the provisions of the Recovery Strategy, the success with which it is implemented, and future states of nature. However, the science advice provides a preliminary scoping of the general neighbourhood of recovery, as comparative benchmarks for exploration of the possible consequences of various recovery scenarios (see steps 6, 8, and 16).

Step 6: The projections should use best analytical practices for forward projections of populations. They should incorporate the uncertainties and co-variances in the population dynamics parameters and uncertainties about future states of nature that are not under management control but may affect a population's productivity and/or survivorship. Guidelines for best practices are provided in the CSAS Research Document 2007/045 and its updates.

This family of projections constitutes the basis for comparison of alternative management and recovery scenarios. However, care should be taken to ensure that the results are presented in risk-based language, and do not appear to be prescriptive or normative science advice. Rather, the advice should communicate clearly the likelihood of achieving the neighbourhood of biologically reasonable recovery targets (step 5) in various time-frames, given *status quo* mortality rates and productivity. To be consistent with the language of SARA, it is useful if the advice can be phrased relative to "jeopardy to survival or recovery of the species". In some cases however, that type of phrasing may be artificial and unclear, and whenever possible the science advice should be phrased in terms of risks to and likelihoods of survival or recovery. If there is risk of continued decline to the species, or of failure to ever reach the neighbourhood of the recovery targets given *status quo* conditions, these risks need to be highlighted clearly in the advice. Three generations are often identified as the target for time to recovery because this interval is an assessment standard for COSEWIC and is used in many publications on conservation biology. However, the various possible trajectories until recovery targets are reached, if feasible, are vital for consultations, social and economic evaluations, and planning by Recovery Teams, and should be a product of RPAs whenever possible.

Step 7: Guidelines on what constitutes the "residence" of a species have not yet been developed. It is important to note though, that many aquatic species do not have a "residence" in the sense intended by SARA, and it is not necessary to describe a "residence" in such cases.

Step 8: Specific scenarios for recovery planning will be explored in later steps in this Protocol. The intent of these projections is to identify the key life history parameters that influence likelihood and time to recovery, and to determine the degree to which changes in mortality and/or productivity would increase the likelihood of or shorten the time to recovery. If survival and recovery of the species is not highly likely even with total mortality set at the value of natural mortality alone, that information needs to be communicated clearly. However, as in step 6 the advice should be in risk-based language and not prescriptive or normative language.

Step 9: It is likely that information will not be available equally on all threats to a species. In every case, the best estimates possible should be provided for the mortality, depressed productivity, or reduction in habitat quality or quantity associated with each threat, rather than seeking a common (and often low) standard for all the estimates. Uncertainties in these estimates should also be provided for subsequent steps. By considering threats involving reduced productivity, and not just threats involving mortality, it should be possible to address non-lethal sources of harm to a species, and the cumulative effects of chronic or recurrent but relatively low-level stresses on populations and their habitats.

Efforts are being made at the pre-COSEWIC peer review meeting and in all subsequent steps, to better describe both the imminence of threats and the maximum severity that could be expected, were the threat to actually occur. Quantitatively, risk is the product of the likelihood of an event and its consequences if it does occur. So providing risk-based advice from RPAs should allow the information on imminence and severity to be used in this and subsequent steps in the Protocol.

Step 10: The same considerations regarding information quality and quantity that were discussed for step 9 also apply to estimates of habitat supply. In addition, it is necessary to ensure that, to the extent that the information allows, the total population that could be supported by existing habitat is estimated. These estimates should take into account the amount of habitat of the various qualities that can be considered to be accessible to the

species, whether currently used by the species or not. In cases where the estimated suitable habitat is fully saturated by the presently depleted population, the advice should make clear the need for habitat measures in the Recovery Strategy. In cases where the estimated population that could be supported by the quantity and quality of suitable habitat that could be occupied is larger than required to meet the general recovery targets estimated in step 5, then the advice should communicate clearly that options exist to specify alternative configurations of Critical Habitat as part of the Recovery Strategy.

Step 11: The same considerations regarding information quality and quantity that were discussed for step 9 also apply to quantifying threats to habitat. It is important that threats considered include threats that decrease the quality or quantity of habitat that could be used by a species, and threats that reduce or prevent access to suitable habitats. Threats to habitat should be interpreted broadly to include threats that would be expected to indirectly reduce habitat quality or quantity, such as loss of riparian vegetation that would result in changes to temperature regimes and sediment loads in a stream.

Steps 12, 13, and 14: These inventories should be developed with substantial input from other sectors of DFO, and where appropriate, industries, stakeholders and public interest groups. However, Science is not precluded from proposing alternatives or mitigation measures that, from biological perspectives, appear to warrant consideration.

Efforts should be made to develop these inventories in advance of the RPA, and simply consolidate and peer review the list of reasonable alternatives and feasible mitigation measures at the meeting because of the uses of these inventories in subsequent steps in the Protocol. The alternatives and measures accepted at this step should be included in the remaining steps in the Protocol, which will often require advance preparations. Reducing mortality and increasing productivity can both be the basis for provisions in Recovery Strategies. Therefore step 14 is on equal status with steps 12 and 13, and options for improving productivity should be evaluated on their own merits and not solely as substitutes or compensation for other sources of mortality or harm to habitats.

Step 15: The same considerations regarding information quality and quantity that were discussed for step 9 also apply to estimating the degree to which the measures in steps 12, 13, and 14 can reduce mortality and/or improve the productivity of the species.

Many measures can be implemented on a variety of scales. In those cases the ideal product at this step would be to describe with risk-based methods how the expected mortality of the species would vary with the scale of activity being considered for the measures in steps 12 and 13, between the *status quo* level of the activity and its complete termination. For the measures in step 14 the range would be from the *status quo* (which may be not doing the activity at all) to whatever is considered the maximum feasible scale of implementation possible.

Step 16: The specific scenarios to explore should be developed with clients of the science advice, to ensure that they are fully informed about the probabilistic consequences of options that they are considering. However, meeting participants should not be constrained from exploring the probabilistic consequences of any scenarios considered important for a full understanding of the recovery potential of the species, and the conditions necessary to maximize the likelihood of recovery.

As in steps 6 and 8, all results should be reported in risk-based language and not prescriptive or normative language. In recognition of the intended purposes of the subsequent steps in recovery planning (consultations, Ministerial decisions, Recovery Strategies, etc.) specific scenarios should not be recommended for implementation at this stage unless clear policy guidance for such advice has been given in the request for advice on the particular species.

Step 17: These will generally be the same parameters identified in step 3, with their associated uncertainties. However, lessons learned in the process of doing projections in steps 9 and 16 should be documented so that they can be applied in any other exploratory projections that are undertaken after the RPA has adjourned. Just as the RPA will be most successful if all other DFO sectors are fully engaged in these steps, any scenario exploration following the RPA meeting that involved projecting population trajectories under different assumptions of population parameters and/or management measures should include Science experts who were involved in the projections made for the RPA.

CONCLUSIONS AND RECOMMENDATIONS

The revised Protocol in the SAR should be implemented as fully as possible in all RPAs. The adoption of risk-based language in the advice from RPAs should proceed as quickly as possible, even in cases when the analytical tools and information basis available for estimating risk are at best qualitative.

Implementation of this Protocol will require increased commitment of both financial and human resources from all Sectors, and particularly from Science, and these commitments need to be made on schedules that do not fit comfortably in the current budgeting and workplanning timetables of DFO. Departmental administration should address these resource and scheduling challenges as a high priority.

This Protocol for RPAs has been developed to be compliant with the provisions of SARA. However, the practices it presents are considered to be best practices for evaluating the likelihood that any depleted population could rebuild to various future sizes under different assumptions about management measures to be implemented as part of rebuilding plans. The Protocol should be considered as general guidance for science advice on planning for longer-term rebuilding of stocks, whether they have been assessed as at risk by COSEWIC or not.

In conducting RPAs, sometimes measures conducive to recovery of one species may conflict with measures conducive to recovery of another species assessed as at risk or otherwise identified as in need of rebuilding. In other cases, it may become clear during the RPA (or in planning for it) that measures that should improve the likelihood of recovery of the species of concern could also improve the likelihood of recovery of other species as well. The Protocol should still be applied on a species-by-species basis, but the specification of scenarios to explore should take these multi-species and ecosystem considerations into account. These potential interactions (positive and negative) should also be highlighted in the scientific advice provided by the RPA.

SOURCES OF INFORMATION

DFO. 2007. Assessing Recovery Potential: Long-Term Projections and their Implications for Socio-Economic Analysis. DFO Can. Sci. Advis. Sec. Res. Doc. 2007/045.

FOR MORE INFORMATION

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ISSN 1480-4913 (Printed)
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La version française est disponible à l'adresse ci-dessus.

CORRECT CITATION FOR THIS PUBLICATION

DFO. 2007. Revised Protocol for Conducting Recovery Potential Assessments. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/039.